Commodore News

OFFICIAL PET USERS' CLUB NEWSLETTER

ISSUE No. Ø4

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We like to publish interesting features from PET Users about their applications and set-ups. If you would like to contribute to the next newsletter, please send your article, letter or comments to:

The Editor,
PET Users' Club,
Commodore Systems,
360 Euston Road,
London NW1 3BL

Please note: To provide a good information service to PET Users, we regularly mention equipment, software and services offered by companies and individuals not directly linked to Commodore. In doing so, we are not making recommendations and cannot be held responsible for the validity of any statements made.

Included with this newsletter, you should have received a copy of the booklet, "PET COMMUNICATION WITH THE OUTSIDE WORLD". This is a free gift (call it an early Christmas present) from Commodore to all PET Users' Club members. It contains a very thorough description of the PET's interfaces, with details of the individual input/output lines, the internal sequence of events and the BASIC commands used. The booklet will prove to be extremely useful to anyone intending to link their PET to another piece of equipment.

Additional copies may be obtained from Commodore for £1.00 plus a stamped addressed envelope.

OVERSEAS SUBSCRIPTIONS

Since we are increasingly getting requests for subscriptions to the PET Users' Club from overseas, we have now decided that this facility will be available, operating in the same way as inside the UK, but for £15.00 per annum. It should be remembered, however, that we do not accept, in this country, orders for equipment or software from overseas.

PET SALES

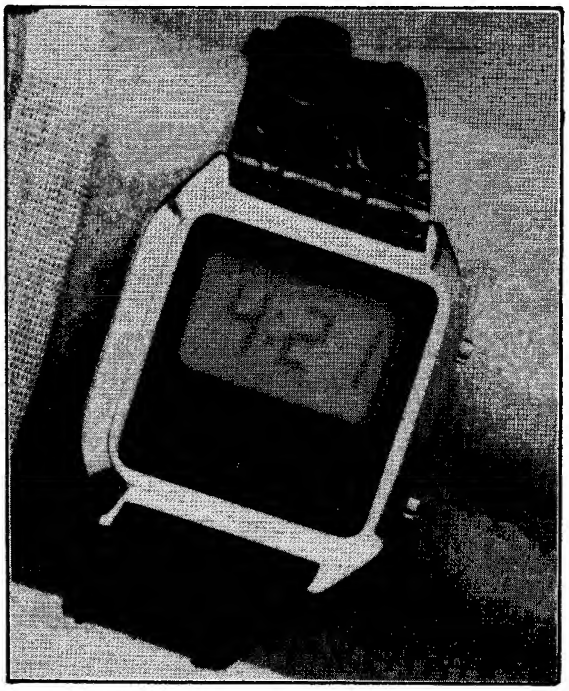
Over 2,000 PETs have now been delivered in this country alone. Inevitably we are now beginning to reap the benefits of such a wide base of applications and software (see Users' Directory, etc.).

SPECIAL OFFERS

With Christmas only six weeks away, most PET Users (if they aren't too busy programming their PETs) will be looking round for good ideas for Christmas presents. As a special offer to PET Users' Club members only, we are making available some other Commodore products at very reasonable prices:

LIQUID CRYSTAL WATCHES

These are 5-function watches, with hours, minutes, seconds, date and month. They both have a backlight for night use and a clear LCD display. The ladies' version (model 35X1) is finished in chrome while the men's watch (also in chrome) comes complete with a matching chrome bracelet. Both are priced at £8.50 including VAT and P & P.



95x3

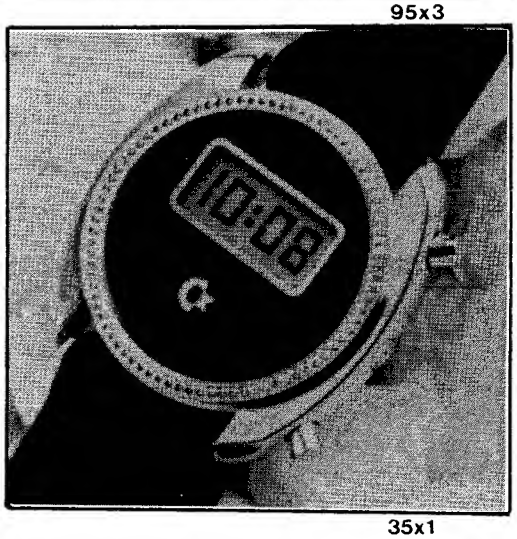
LED CALCULATORS

Model 797

A 4-function calculator with a full 4-key memory, % and exchange keys. Users' Club Price £3.95 including VAT and P & P

Model 7919

This very popluar basic scientific calculator has trigs, logs, powers and roots and 1 memory. The display is 8-digit, with a 5 + 2 exponent mode. Users' Club Price £5.95 including VAT and P & P



35x1

Offers are subject to availability so take advantage of these prices while you can. Delivery is approximately 21 days from receipt of cheque. This offer is available only to PET Users' Club members by the use of the order form below.

To: Commodore Business Machines
Industrial Estate
Eaglescliffe
Stockton-on-Tees
County Cleveland Tel. 0642 780014

Please send me the following items at the PET USERS' CLUB special offer price:

.....	35X1 Ladies LCD Watch	@	£8.50 each	.....
.....	95X3 Mens LCD Watch	@	£8.50 each	.....
.....	797 LED Calculator	@	£3.95 each	.....
.....	7919 LED Scientific Calc.	@	£5.95 each	.....

(All prices include VAT and P & P) TOTAL _____

I enclose a cheque made payable to:
Commodore Business Machines (UK) Limited
for the amount of £.....

NAME: .....
Address: .....
.....
.....

PLEASE USE BLOCK CAPITALS

Software

In this section we shall be dealing with the software available from Commodore for the PET. Our Master Library contains professionally written, well documented programs which have been tried and tested prior to release. The Common Library consists of programs written by PET Users for sale at very low cost.

We shall also be reviewing the latest programs in some detail and be making some general comments about obtaining software for your PET.

COMMON LIBRARY

Below is a list of all the programs currently available from the Common Library. If you would like to submit a program that you have written please note the following:

1. Programs submitted should be on cassette - we regret that we cannot return them, so please keep a copy.
2. All programs should be "Self-documenting" as we do not supply booklets with these programs.
3. Submissions should be sent to the Software Manager at Commodore. Please include your name and address.
4. For every accepted program we will send out four free Common Library programs of your choice.

The list is as follows:

PROGRAM NUMBER	NAME	AUTHOR	DESCRIPTION
CLØØ1	ESP TEST	Mr. Chambers	Tests ability to 'perceive' random numbers
CLØØ2	SLOT MACHINE	"	
CLØØ3	MASTERMIND	Mr. McDonald	
CLØØ4	MOO	Prof. A. Colin	Guess numbers against computer
CLØØ5	LIFE	Mr. Wheatcroft	
CLØØ6	STARWARS	Dr. Lucas	Based on a raid on 'Death Star'
CLØØ7	ONE ARM BANDIT	A. M. Robertson	Good graphics
CLØØ8	DEEPSPACER	D. A. Allen	Space game
CLØØ9	SOLVING SIMULTANEOUS EQUATIONS	Prof. A. Colin	Up to 16 variables
CLØ1Ø	MEMORY DISPLAY IN HEX	Mr. Tribe	
All the following are new this issue:			
CLØ11	CAR MAZE	Unknown	Allows you to drive a vehicle through a random maze
CLØ12	BOXES	Unknown	A version of the children's game "squares". You play against the computer
CLØ13	GOLF	M. J. Lake	Reasonable graphics. You choose your handicap, confess your weaknesses
CLØ14	CONCENTRATION	F. T. Chambers	Computer implementation of Pelmanism type card game
CLØ15	21 CARD TRICK	L. M. Gold	Computer implementation of traditional party game
CLØ16	PATIENCE	X. Houching	Known in US as Solitaire
CLØ17	SOLITAIRE	J. R. Park	Traditional European board game
CLØ18	DARTS	E. Bloomfield	Workmanlike simulation of famous game
CLØ19	CRAPS	Prof. A. Collin	The Dice Game
CLØ2Ø	TANK	C. Tuppen	Original tank battle game

CLØ21	U BOAT	D. Langford	A nice graphic. You sink ships
CLØ22	BOMB DROP	B. P. O'Hare	Aim your bomb to hit a target
CLØ23	ROBOT CHASE	O. F. Bulmer	Defend yourself with mine-fields as robots close in to wipe you out.
CLØ24	K-SCOPE	B. P. O'Hare	Produces kaleidoscope patterns
CLØ25	WIDGETS	Dr. R. Botting	Factory economics simulation
CLØ26	SPECULATION	C. Ryan	Stock market simulation
CLØ27	LIFE (machine code)	M. Taylor	Conway's Life game (taken from Micro Journal. Screen crackle suppressed)
CLØ28	TIMES TABLE	W. Lyons	Teach your children the rudiments
CLØ29	BASE CONVERSION	R. C. Gentry	Converts a number of any base to a number of any other base
CLØ3Ø	NON-PARAMETRIC STATISTICS	P. Harper	Mann-Whitney & Spearman tests
CLØ31	DISPLAY F(X)	C Tuppen	High resolution graphic plotter
CLØ32	3D PLOT	A. Picken & C. Bullock	Attempts to display functions of two variables

To order Common Library programs, please quote Program Number and Name.

Minimum Order - 4 programs - £5.00

Each additional program - £1.25

Prices include VAT and P+P

Cheques made to: Commodore Business Machines (UK) Limited

Please send orders to:

Commodore Systems

360 Euston Road

London NW1 3BL

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TITLES OF RECENT SUBMISSIONS TO SOFTWARE MANAGER INCLUDE:

ROOTS
BACKGAMMON
MORTGAGE
LINE RENUMBER
STAR TREK
BASIC COURSE FOR BEGINNERS
GOMOKU
MAGIC SQUARES
BEARHUNT
STARSHIP
MAZER
4K PLOT
DIFFUSION
CARTESIAN AXIS PLOT
MAZE
MATRIX INVERT
DENSE Y PLOT
TAPESTRY
MINATOR
SIMULTANEOUS EQUATIONS
CABLE SIZES
JUMBO JET LANDER
RANDOM AND PATRIOT (WITH AUDIO)
SHOOT
PUZZLE
HP45
PROFIT VOLUME WITH COST
ECONOMIC ORDER QUANTITY
TIME
"PETUNES" - NO PLACE LIKE HOME
- CRADLE SONG
- SINGER SONG
- SIXPENCE
- ADESTE FIDELES
IEEE AUDIO TEST PROGRAMME
6522 DISPLAY
OSCAR
BATTLESHIP
CRICKET
CHOOSE A NAME

Those which are suitable will be available in December.

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BUSINESS

PAYROLL - £25.00 Order No. MPØ21

Designed by a practising UK accountant, this suite of programs comes in two versions (both are included). One for use with a stand alone PET can handle up to 20 employees. The other is for use with an external cassette deck and can handle up to 100 employees. The program handles NHI status, tax codes, weekly/monthly/hourly employees, 3 overtime rates and loans. The program works on a Grandfather, father and son basis. The program has an option for the user to choose to display the results on the screen or to print them out. A separate maintenance agreement (£10 annually) can be taken out with the author directly who will update users' programs when changes in government legislation occur.

ROCKSTOCK - £20.00 Order No. MPØ22

This is a stock control program designed to work on a PET system with a second external cassette deck. The use of a second cassette deck enables a virtually limitless number of items to be stored on tape. A feature of this program is that depending on the user's security level a password ensures that not all items on record will be displayed, e.g. buying price. This program is best suited when transactions are entered once daily and a daily summary of the latest position of a large number of items is then required.

ARDENSTOCK - £15.00 Order No. MPØ23

This is a stock control program designed to work on a stand alone PET. The program will handle up to 90 products recording any period of issues and receipts as well as reporting their free stock position and stock value. Re-order levels can be set and 'on order' goods also shown. This program is best suited when quicker information is needed on a relatively small number of items.

COSTING - £10.00 Order No. MPØ25

Cost report generating system covers up to 200 descriptions and costs. This can be altered by adding new records or changing existing ones. A two part coding system gives the grand total of the records and also up to 20 sub totals. The second part of the coding system allows for another 20 sub totals to be used independantly. It is easy for the user to specify the changes he wishes to make. Once the initial file set up has been performed, only one program is required to edit, add and delete records and print out the various totals available. This system is well documented and should be understood by inexperienced users.

DATA BASE UTILITY - £15.00 Order No. MPØ24

This is an aid to businessmen wanting to design their own systems and will help them create their own programs for such areas as stock control, mailing lists and personnel records. It allows the user to create, maintain and examine files of data on cassettes. Although such files contain within themselves descriptions of the file structure, the actual user data can readily be processed by the user's own application program. The file contains logical records with a common format; all data is held as strings. Second cassette deck needed.

SURVEY ANALYSIS - £8.00 Order No. MPØ27

This program will analyse the coded results of a small to medium size survey, e.g. 80 responses to a questionnaire of 12 questions.

GAMES

OTHELLO - £8.00 Order No. MPØ1Ø

Othello is a game of strategy played on a 8 x 8 board, much like a chess board. The object is to surround your enemy and convert the enemy pieces to your side. It's a game where the last moves can be quite decisive. You play against the PET brain.

PONTOON - £6.00 Order No. MPØ11

The popular card game has a true 52 card pack plus amazing graphics. You bet against the house (the PET).

WRAP TRAP - £8.00 Order No. MPØ12

Dynamic graphics game in which the player has to trap the computer. Good arcade quality graphics.

ROTATE - £5.00 Order No. MPØ14

Difficult if you are not an expert! Similar to little plastic trays with moveable letters and letter missing.

LUNAR LANDER - £8.00 Order No. MPØ15

You must make the Lunar Excursion Module land safely on the moon. By regulating the falling speed, the counterthrust of the rockets and the amount of fuel required, you should be able to accomplish this objective. If you fail, the marvellous graphics will show the Lunar Lander smashing to the surface of the moon.

continued...

OFFICIAL MASTER PROGRAM LIBRARY *(On cassette)*

TUTORIAL/EDUCATIONAL

BASIC BASIC - £9.00 Order No. MPØØ1

A real tutorial program, introducing you to the BASIC language. Thoroughly interactive: your PET will teach you how to operate your PET! You proceed at your own pace. You should actually be able to learn PET's BASIC in several hours and then begin your own programming. Basic BASIC is written by two very experienced college professors. The topics covered include line numbers, variables, strings, arrays and the use of the various commands such as LIST, RUN and SAVE. Also basic keywords will be explained and used such as PRINT, READ/DATA, INPUT, IF/THEN, GOTO and FOR/NEXT. Fifteen chapters, six sample programs ..... and homework assignments.

SQUIGGLE/BIG TIME - £4.00 Order No. MPØØ2

Squiggle draws wriggly patterns on the PET screen and illustrates programmed cursor movement, graphics characters and use of the random function. You can adjust the randomness of Squiggle's pattern with the number you give it when Squiggle starts. Bigtime displays the time, showing PET's timing capabilities; and how to use the PET as the world's most expensive digital clock. An accompanying booklet describes the programming techniques used.

SNARK - £12.00 Order No. MPØ26

This program is written by a well known Professor of Computer Science. It converts PET into a simulated 16 bit abstract machine designed for use in an elementary Computer Science course. It aims to teach the elements of machine code programming.

PROGRAMMING AIDS

DISASSEMBLER - £15.00 Order No. MPØØ3

6500 series full disassembler asks for decimal starting location and lists from this point, gives full mnemonics and handles ASCII tables.

MACHINE CODE HANDLER - £3.00 Order No. MPØØ4

This program allows you to type a list of HEX codes from a given location. These routines can then be called using the SYS verb.

MACHINE LANGUAGE MONITOR - £4.00 Order No. MPØØ5

A full HEX monitor similar to the KIM 1 operating system.

HEX EDITOR AND LOADER - £3.00 Order No. MPØØ6

This allows you to edit, insert, delete, load and save HEX programs.

SCIENTIFIC/MATHEMATICAL

BASIC MATHS PACKAGE - £15.00 Order No. MPØØ7

This does matrix addition, multiplication, determinants and inverses to 16 x 16 solution of simultaneous linear equations, vector and plane geometry calculations, integration by trapezoidal, Simpson's rule or Gaussian quadrature, differentation. (December release)

BASIC STATISTICS PACKAGE - £15.00 Order No. MPØØ8

Mean, median, variance, standard deviation, skewness, kurtosis, frequency distribution, linear regression, T-tests, correlation analyses. (December release)

LEAST SQUARES - £3.00 Order No. MPØ29

This program uses a well established formula for fitting a curve to any set of data points.

FINANCIAL

MORTGAGE ANALYSIS - £9.00 Order No. MPØØ9

Enter the principal amount, the term and the annual interest rate and the PET will compute the periodic payments, the total payments and the total interest for the mortgage. You enter the starting date and the PET will display monthly, quarterly, semi-annual or annual payments. The status of the mortgage (or loan) at any date can then be displayed, showing the interest/principal split of the previous payment, the interest, principal and total paid thus far and still outstanding and the number of payments remaining.

BIORHYTHMS - £8.00 Order No. MPØ16

Will indicate your intellectual, emotional and physical cycles according to a well regarded series of computations based on behaviour. On an accurately drawn chart, the display will show the highs and lows of each of the three cycles.

TARGET PONG and OFF THE WALL - £6.00 Order No. MPØ17

Target Pong - insert paddles in the path of a fast moving ball to deflect the ball into a target. The secret is to use the fewest number of paddles and the least time to hit the target. Off the Wall is exactly the opposite. Here the secret is to use as many paddles as you can without hitting the targets. And to make things more difficult there are many targets in this game.

GALAXY GAMES - £6.00 Order No. MPØ18

Here are two tough but entertaining games. In both you are required to manoeuvre your space ship while firing at the enemy, and at the same time, to avoid hitting a star. In one game, you're firing at a spaceship that's piloted by an obviously drunk astronaut!

SPACE FIGHT - £6.00 Order No. MPØ19

Fire missiles at each other in this two player game. But there's a warning: each missile has limited range and if the missile doesn't hit the enemy, watch out! You could run into your own missile and lose .... and feel very silly. A game for all ages with emphasis on the younger people.

DRAW POKER - £6.00 Order No. MPØ2Ø

Perhaps we've been minimizing the quality of the superb graphics available. With Draw Poker and Pontoon you have perfect examples of the kind of graphics we are talking about. Here you play Draw Poker against the house with two pair or better to win. The House is a tough - but fair - dealer. Of course the House is your PET.

PROGRAMME FEATURES

In this issue we are reviewing the two stock control programs available from the Commodore Master List.

1. ARDENSTOCK

This program has been designed for use on a standard PET (ie with 8K bytes of memory and one built-in cassette drive). Ideally suited to the small business user, it can handle up to 90 different product lines simultaneously and is comprehensive enough to be used by someone with no computer experience at all.

Once having set up your initial stock position on tape, stock transactions are entered via the keyboard as they are executed. Instant access to the stock position of any item is always available and at the end of each day the new records are transfered back onto tape.

The data stored for each product line is as follows:

1. Product number
2. Description
3. Physical stock
4. Quantity on order
5. Free stock (3 + 4)
6. Re-order level
7. Re-order quantity
8. Period issues
9. Period receipts

The last two quantities enable you to keep track on how well each particular line is moving over a specific period. At the end of each day, you have the option of resetting these values to zero (ie end of the period) or retaining them so as to do a longer period check.

All in all this is a well-written program and is ideal for many PET Users who require a simple yet comprehensive stock control system. It is available on tape - complete with documentation - for £15.

2. ROCKSTOCK

This is the more advanced of the two programs and requires an 8K PET plus a second cassette deck. This enables it to cope with an unlimited number of product lines - time being the only constraint.

As with Ardenstock, the operation of the program is simple, it having three main functions,

i) creating a new master file of stock records
ii) examining a stock file
iii) updating a stock file

all three of which are executed by the same program.

One very professional aspect of this system is the built-in security. All stock files have filenames to distinguish them and a "password" to prevent records from being accidently altered. Three different levels of authority are provided so that, for instance, only someone with the full password can alter the selling price of a product. This makes the system ideal for use in a larger establishment where it may have many operators.

Information stored on each product includes:

1. Buying price
2. Selling price
3. Quantity in stock
4. Minimum stock level
5. Description

and the functions are:

Look at product record
Order product
Add to, or sell from, stock
Amend product record
Create new record.

The system works by taking the "old" records from the external cassette deck and printing the "new" records onto the built-in cassette deck.

The program is a professional system and should prove ideal for many business applications. It is available on cassette - complete with documentation - for £20.

STATISTICS PROGRAMS

A range of statistics programs are now available from CYTEK UK Limited (PET Dealers in Manchester). Titles so far include:

T-test/U-test
Paired-T/Wilcox
Spearmans
Polynomial Regression (Least Squares)
Multiple Regression with variable deletion
ANOVA-Factorial
1-Way ANOVA (Several Groups)
Randomisation

For more details of these and other programs, write to:

Cytek (UK) Limited,
17 Exchange Hall,
Corn Exchange Building,
Manchester M4 3EY

or ring Mr. Menhinick on 061-832 7604.

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Commodore is pleased to announce that the documentation for several of its new programs has been increased. The instructions for the more expensive programs now come in well laid out A4 size booklets.

MINI-MICRO
COMPUTER GAMES
47, QUEENS ROAD,
LONDON, N11 2QP

TEL : 01-889 7615

A selection from the "PET GAMES" Catalogue (Sept. 78)

(All Games on high quality C12 Cassette Tape, to CBM PET standards)

ACEY-DUCEY (1 Player) A great Game writer described this gambling card game as an occupational disease. Very good "real" cards display. A must for anyone with a gambling streak. . . . . (£ 6.00)

MASTERMIND (1 Player against PET) A "Jumbo" version of this traditional Code-Breaking game. The Code, 7 digits long, must be broken in 10 attempts maximum. (Difficult...) The smart display features automatic positioning of your guesses, gives clues and shows PET's screen facilities at their best. A treat. . . . . (£ 4.50)

ONE ARM PET (1 Player) A marvellous way to recoup the cost of your PET from your friends. The most sophisticated Bandit ever. You will be thrilled by its display and its options: Hold any window(s) ... Shoot for Gold or Silver ... Automatic mark up or down of your gains or losses. A definitive party winner. . . . . (£ 6.00)

CHINESE FAN-TAN (2 to 8 Players) An old oriental Casino game. Bet on a number, if it comes up you are paid double your stake; bet between two numbers, if either of these numbers comes up you are paid even money. The large number of players this program can accommodate(8) makes it the ideal choice for a party. It is totally addictive . . (£ 6.00)

A MAZE (1 Player) Creates a different maze at each run; you have 75 moves to extricate yourself from it. Very ingenious dynamic graphics. Quick game, good for instant relaxation. . . . . (£ 2.00)

THE RULER (1 Player) Management game. You are in charge of a whole town, its populace and resources for a term of 7 years. It is up to you to make the city prosper, but don't think it will be all roses: natural disasters; strikes; political unrest and unemployment problems could be facing you at any time. Make one wrong decision and your economy could be threatened. Too many mistakes and you will be impeached. For would be Prime Ministers and economists. . . . . (£ 4.50)

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AND MANY MORE

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Phone or write N O W for our complete Catalogue.

MAIL ORDER ONLY. All cheques, P.O. etc., made payable to MINI MICRO.

Peripherals & Attachments

MINI-FLOPPY DISC REVIEW

The cassette file handling system built into the PET is both efficient and easy to use. It is not, however, a fast system and there are some applications - particularly business ones - where a faster system would be invaluable. A floppy disc provides high speed access to a vast amount of data (or programs) and Commodore are developing a PET mini-floppy disc system to sell at a very competitive price early next year.

Meanwhile, however, a new company, called Midland Micronics (associated with Taylor-Wilson Systems Limited), have just developed a mini-floppy disc system especially for the PET - called the MM3. In line with our policy of keeping PET Users up to date with the latest developments, we have decided to review this new peripheral at its launch.

THE MIDLAND MICRONICS MM3 MINI-FLOPPY DISC SYSTEM

The first thing that strikes you about the MM3 is the excellent external design. The twin floppy unit sits as a saddle over the PET's VDU with one drive mounted vertically at each side. The steel casing is styled and painted to match the PET and once set up, the whole system looks like one integrated unit - in keeping with the original PET concept.

Inside, the controller is operated by an Intel 8048 microprocessor and sports a set of commands to perform all the necessary functions in transferring data between the PET and the disc drives.

On the prototype I saw, the controller (written in machine code) was fed in from a cassette tape after switching on. The production model, however, will have this on an additional ROM inside the PET and hence will not occupy any RAM space at all. The new ROM will "piggy back" onto one of the PET's ROMs and apart from the main connector (which goes through the memory expansion port) is the only connection to the PET; the floppies have a separate mains power supply.

Although there are a few details to finish before the first model rolls off the line, the research and development is moving at a commendable rate. In between viewing the system on Saturday 21st October and Monday 23rd October it had increased in specification considerably! Some parts of production have already begun and Midland Micronics say they will commence delivery on 20th November.

Turning to the operation of the system, this is no more difficult than the PET cassette system and functions equivalent to SAVE, LOAD, OPEN, CLOSE, PRINT, INPUT, GET, etc, are directly available.

Each disc can output up to 80K bytes of useful data - in addition to the space taken up for its own operation. The 5¼" magnetic discs themselves can be flipped over to give a total of 160K bytes of useful data each. The time to seek out a particular data file or program on the disc is estimated at an average of 370 micro-seconds (which is somewhat faster than the cassette!!!). Once having located a file, data is transfered to the PET at least 40 times faster than the cassette - a demonstration of 'WRAP TRAP' and other games being loaded in under 2 seconds is quite convincing.

Actual disc-operation functions are executed in a BASIC program with the USR instruction. These include:

FORMAT to format the disc into 40 tracks by 16 sectors prior to use.

CATALOGUE to search through a complete disc and list the names of all the files on that disc. (This takes just a few seconds.)

DRIVE to specify which of the two disc drives you are referring to.

In conclusion, this system has been designed with PET Users in mind. It is both simple to operate and very fast, making it ideal for many business applications such as stock control and accounting. For those users who cannot afford to wait for Commodore's own disc system, the MM3 will provide them with an immediate solution.

For further details of the system, write to:

Mr. Peter New
Midland Micronics
Oakfield House
Station Road
Dorridge
Solihull Tel: 05645 6192

Price of the MM3 twin drive is £1,300 + VAT
Single drive stand alone disc: £870 + VAT

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HIGH QUALITY PRINTING

We get frequent requests for information on how to link the PET to a high quality golfball printer, such as an IBM typewriter. This would make possible business letters and invoicing in a presentable form, and in view of the number of word processing programs appearing, the advent of a PET word processing system is not too far away. We were thus pleased to hear that one of our PET dealers - G R Electronics Limited - is now selling a PET compatible golfball printer.

Based on the reliable IBM 3982 'Golfball' unit, it gives full ASCII printer facilities, with the ability to change typefaces and founts to suit different applications. It will copy letters, invoices, program listings, etc, in capitals and lower case, either as set up on the PET's screen or retrieved from its memory. Printing speed is 15 characters/second with a line width of 130 characters. The pitch is 10 characters/inch, though it may be modified to 12 pitch if required.

The printer is driven via the 8-bit user port and is controlled by a machine code program which is supplied on cassette and takes up only ¼K byte of memory. This method of operation gives the User complete flexibility in code conversion and timing as well as 'carriage return', 'line feed', 'tab' and 'backspace' functions. It includes routines for listing PEEK/POKE characters, solenoid codes and characters actually printed.

The printers themselves are second-user, heavy-duty units, regularly maintained during their initial service lives as satelite printers in a large distributed system. They have been reconditioned by an IBM specialist, from whom service and repair facilities are available.

Price for the printer complete with interface and software cassette is £475.

For further details contact:

G R Electronics Limited
Fairoak House
Church Road
Newport
Gwent
NPT 7EJ

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IJJ MEMORY EXPANSION BOARDS

Since the last issue, we have seen and tried one of the IJJ Designs Limited memory expansion boards. We understand that demand for the boards is heavy, but IJJ say they hope to meet new orders from stock by the end of November. A machine code program to test all memory locations will be available soon at a price of £5. For more details ring John Irwin on Marlborough 52818 after 7.00 pm.

R.BAILEY ASSOCIATES
IS NOW TRADING AS A
DIVISION OF SMALL
SYSTEMS ENGINEERING Ltd.

SMALL SYSTEMS ENGINEERING LTD
62 New Cavendish Street,
London W1M 7LD.
Telephone : 01 - 637 0777

RETAIL PRICE LIST

PET MEMORY BOARDS

An internally mounting memory expansion board is available in two configurations:
- 24576 bytes (24K)
- 32768 bytes (32K)

Installation of the memory board is extremely simple. The board mounts on spacers which screw into the main PET board in place of the existing self-tapping screws.

Each memory board is supplied with full installation instructions and a test program listing.

Price: - 24K : £495.00
- 32K : £570.00

Delivery: - 2-3 weeks

IEEE/RS232C SERIAL INTERFACE A

A unidirectional interface suitable for any printer or serial device requiring V24/RS232C or 20mA current loop signals. The interface may be used with up to 15 other devices simultaneously connected to the IEEE bus.

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TERMS

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Applications

There are almost as many applications for a PET as there are PET's themselves. We would like to find out what the PET is being used for so that we can pass on relevent delails to other people interested in the same area of use.

We are thus offering £25 worth of free Master Library software to the best 'Applications' article published in each issue. If you would like to write about what you are doing with your PET please include the following details:

1. What the nature of the application is.
2. What (if applicable) non-computerised system has the PET replaced.
3. Details of any extra hardware used.
4. Any "special features" of the programs used.
5. Who else this system might be useful to.
6. Any further improvements/modifications intended.

The application featured this time is perhaps an unusual one - it concerns school meals. Many PETs have already been sold to Secondary Schools and an application to the administration side of a school increases even more the potential of PET as a schools computer. The article indicates that the PET has not only been useful to operate the system, but has provided another invaluable function - encouraging someone to learn and practise BASIC programming.

MONITORING COST AND NUTRITION IN SCHOOL MEALS

"As a Cook Supervisor of a girls secondary school in Cheshire, my responsibilities include meeting cost targets and nutritional standards set by the School Meals Service. In particular I have to produce meals with ingredients costing out as closely as possible to a set figure and at the same time having a protein content in excess of a set minimum.

These two statistics are currently computed by a central staff at Chester. I get the results 7-8 weeks after the meal has been prepared and eaten. To be informed at this stage that my costs are too high, or protein too low, is rather like telling off a child two months after the 'event'!

My husband has taught me the rudiments of BASIC. He is now neck deep in machine code, driving himself, and me, mad. (I do find it just a little disconcerting to hear him shout out in bed "Shift Left", "Rotate", "Load Immediate", only to find he's talking in his sleep!!) So I decided to write a School Meals Statistics Program on my own.

The initial requirements were to produce, each week,

1. the average ingredient cost of a school meal, broken down into four categories according to food type, and
2. the average protein content of a school meal.

The data available was:

1. My own stock sheets which show daily and weekly quantities used for each of approximately 150 ingredients; their cost per unit quantity and which food category they belong to.

2. Protein content data for each ingredient. This was kindly supplied by the Chester office, who showed some interest in my project.

The first task was to create the main file on tape. Our PET being just the basic configuration, the whole file has to be read into store before processing. The data for each ingredient is packed to save string space. The record for each item takes the form ingredient name/category/protein content/ (where "/" is an item separator). A sequence number, cross-referencing to the stock sheets, is generated for each ingredient by the main program so is not required on the file. A glance at the old stock sheets and some experimentation showed that cost update runs would be required every week if costs were held on file, requiring an extra six minutes of data entry, processing and tape writing time. On the other hand entering costs as data on each weekly run takes less than three minutes.

Creating the file was the biggest chore. I arranged the program so that I could type from the stock sheets, with an assistant calling out protein values for each item as we came to it.

The calculations involved in the weekly run program are negligable - just a matter of accumulating totals and finding averages. The main programming effort was in formatting the input and output.

After reading the entire file, a set of headings appears on the screen

NO. ITEM AMOUNT COST

then for each item the sequence number and ingredient description appear, while the cursor tabs to AMOUNT. Zero or Null 'Return' wipes out that item replacing it with the next. 'E' causes the program to go on to the next stage. Otherwise, the cursor tabs to COST. When this is entered, the total for the relevant Category is updated by AMOUNT times COST and the protein total by AMOUNT times PROTEIN.

Originally there was no provision for error correction. Once the totals were updated, the data was lost. However, there was sufficient space left to amend the program to record the AMOUNT/COST for each item, packed onto the end of the existing data in store. Two additional routines now allow for error correction. 'R' followed by the sequence (or line) number of the suspect item gets the totals 'Deupdated' and the item details displayed again for new data entry before resuming normal sequence. The other lists Line Number, Ingredient, Amount and Cost for all items processed so far, twenty per page in groups of five.

Once all ingredient data is in, the program asks for the total number of meals. When this is entered, the results are calculated - division, rounding and right align - and displayed as a table. I copy this onto the bottom of my stock sheets for a permanent record. There are only six figures, so it is no chore.

The time for a run is approximately 12 minutes for data entry and under one minute for tape reading. If I had access to the PET in the school kitchen, I could obtain daily figures before the meal was served.

There are no special tricks in the program. I used my husband's home-brewed Renumber and Append programs to latch on several of his standard subroutines, such as "Data Entry", "File Write" and "Round and Align Right" which, frankly, have coding I do not understand, although I know what goes in and what comes out the other end.

Planning took possibly 3-4 hours over a two week period, the programming took me about five hours over one weekend and, with help from my husband, was debugged in another half hour. He had a bit of a giggle at some of my coding but his attitude has been - "If it works, leave it alone". I feel quite a sense of accomplishment and got a great deal of pleasure from writing the program plus a moment of ecstasy when the results of the first run tallied exactly with our laborious hand calculations.

Perhaps more importantly, my confidence in programming in BASIC has increased considerably. I feel ready to tackle something more complex. To this end I am now working on a Menu Planning Program which takes into account not only the criteria set by the School Meals Service but also what my girls like to eat!!"

JANET GROSS NIKLAUS
25 Longdown Road, Congleton, Cheshire

Programming

HIGH SPEED FILE ACCESS

There are many PET applications which require the reading and writing of several data files in one program. Since it is often inconvenient (or too expensive) to keep each file on a separate tape, it is normal practice to record several jobs on one tape - distinguished by their filenames. However, this can mean a long wait while searching for a file towards the end of the tape and many users have been looking for a way to decrease this search time.

This article describes one very good method, by using a short subroutine to control the cassette drive in 'FAST FORWARD' mode prior to writing or reading a file. By keeping note of the Fast Forward times, any particular file can be located at a much higher speed and with a reasonable degree of accuracy. To make use of this facility, proceed as follows:

1. Enter the following subroutine (suitably re-numbered if necessary) into your program:

```
1ØØØ    ?"♥ Rewind the cassette and then lift up the
        cassette lid"
1Ø1Ø    ?:?"Press   F.FWD   and then   RETURN":GOSUB 12ØØ
1Ø2Ø    ?:?"Wait for a moment"
1Ø3Ø    OPEN 1,1,1
1Ø4Ø    ?"Now push the cassette back into the deck
        and press   RETURN"
1Ø5Ø    GOSUB 12ØØ
1Ø6Ø    ?"♥Fast forwarding for "T" seconds"
1Ø7Ø    Z = TI:POKE59411,53
1Ø8Ø    If TI<Z+6O*T-34ØTHEN1Ø8Ø
1Ø9Ø    POKE 59411,6Ø:Close 1
11ØØ    ?"♥Now in position"
111Ø    ?"Press  Stop  on Cassette#1 then  RETURN"
12ØØ    Get A$:IfA$=""Then 12ØØ
121Ø    RETURN
```

2. To Fast Forward for 'n' seconds, set T=n and GOSUB to the above subroutine. Try this a few times and you will soon get the idea.

3. The basic idea when handling a number of files is to record them in known places. Before 'OPENing' to write a file, one might use the subroutine to Fast Forward for eight seconds. Thus to access that particular file later, simply Fast Forward (again using the subroutine for eight seconds) before 'OPENing' to read.

   A typical program using this idea might look something like this:

```
      .
      .
      .
1ØØ       T=1Ø:GOSUB1ØØØ                  F.FWD for 10 seconds
11Ø       POKE 243,122:POKE 244,2          see Issues No. 1 & 2
12Ø       OPEN 1,1,1,"FILE 1"
      .
      .                                    Write data for
      .                                    file 1
19Ø       CLOSE 1
      .
      .
      .
35Ø       T=15:GOSUB1ØØØ
36Ø       POKE 243,122:POKE 244,2
37Ø       OPEN 1,1,1,"FILE 2"
      .
      .                                    Write data for
      .                                    file 2
41Ø       CLOSE 1
      .                                    Having written files,
      .                                    they can be read back
      .                                    as follows:
```

```
53Ø       T=1Ø:GOSUB1ØØØ                    F.FWD to file 1
54Ø       OPEN 1,1,Ø,"FILE 2"
     .
     .                                      Read back file 2
     .
58Ø       CLOSE 1
     .
     .
     .
71Ø       T=15:GOSUB1ØØØ
72Ø       OPEN 1,1,Ø,"FILE 2"
     .                                      Read back file 2
     .
     .
83Ø       CLOSE 1
     .
     .
     .
```

This system - if used correctly - can save you a lot of time in searching for files and hence has many applications in business and other programs.

The following points should be noted:

a) The Fast Forward on a cassette deck is not linear - the tape travels faster as more is wound on the accepting spool. This means that for recording files of the same length, the larger values of T can be closer together than the low ones.

b) Different types of tape and different PETs Fast Forward at slightly different speeds. We therefore recommend that for a particular program, you stick to one type of tape and one PET.

c) Trial and error is the only real way of discovering just how close together you can pack your values of T.

d) Do not try to Fast Forward for T less than six seconds.

e) After Fast Forwarding, the PET will still allow a gap of several seconds (at playing speed) before starting to write a file. This is, in fact, useful as it allows a safety margin when re-accessing the file.

f) The system described in this article could be extended to form an almost automatic filing system, where each tape had a 'catalogue' at the start giving the filenames and Fast Forward times to all the files on that tape. An improved subroutine would look up this value and hence find any file by name - very quickly. We would very much like to hear from any User who takes up this idea.

g) The subroutine at the moment takes up 425 bytes of storage. After some practice, however, much of the prompting and wording can be removed or abbreviated.

"EXTRA USE OF THE VERIFY COMMAND

VERIFY has the useful property of reading a program without loading it. Even if an error is detected, it is not displayed until the whole program has been read.

This provides a quick means of finding the end of a program on a cassette without losing what you currently have in the memory.

For example, one is occasionally in the position of having loaded a program, rewound the tape, modified the program and now wish to save the new version after the old. Using an extra tape, this can be done using LOAD and SAVE, with a bit of shuffling.

Quicker however is to use the VERIFY command. When the error message appears, you know you are at the end of the old program. Select STOP on the cassette and SAVE in the normal way. (Remember to use a program name with a different initial character from the old one!)"

Mike Nicklaus
25 Longdown Road, Congleton

IEEE BUS HANDSHAKE ROUTINE IN MACHINE LANGUAGE

To use the IEEE-488 bus on the PET at maximum speed it is necessary to use machine language rather than BASIC 'INPUT' and 'PRINT'. The routine given here has been used with an HP3437A systems voltmeter to reach data transfer speeds of over 5000 bytes per second, corresponding to 2500 voltage readings in 2-byte packed binary format or 625 readings in 8-byte ASCII format. The best speed attained in BASIC is 75 readings per second transferred as character strings.

The IEEE bus

Details of the IEEE-488 bus are given in the PET Users Handbook, but some clarification of the register addresses on page 120 of the handbook is helpful. These are:

HEX	DECIMAL	BITS	IEEE	DIRECTION
E820	59424	0-7	DIO 1-8	from bus
E822	59426	0-7	DIO 1-8	to bus; 'PET'controlled
E821	59425	3	NDAC	'PET' controlled
E823	59427	3	DAV	'PET' controlled
E840	59456	0	NDAC	from bus
		1	NRFD	'PET' controlled
		2	ATN	'PET' controlled
		6	NRFD	from bus
		7	DAV	from bus

Note that on the IEEE bus, 'high' is logic false and 'low' is logic true; and that the data bus must be left with all bits 'high' when PET has finished to avoid confusion of data put on to the bus by other devices.

The program

The program controls a given number of data transfers, each of 8 bytes, from the HP3437A to the PET. Each one is preceded by a trigger (GET - group execute trigger) on the IEEE bus, and the HP3437A must be correctly addressed as a 'talker' or a 'listener' at all times by sending MTA (my talk address) or MLA (my listen address) before transfers as appropriate. The sending of messages (GET, MTA, MLA, etc.) or data is controlled by the ATN line; ATN is true when messages are being sent.

The program and returned data are held in the top 2K of memory; this is hidden from BASIC using POKE 134,255 : POKE 135,23 as the first line of the BASIC control program. The number of readings required is POKEd into 6400_{10}, then control passed to the machine language program by SYS(6144). The data bytes coming in on the IEEE bus are stored in locations 6401_{10} onwards; these are PEEKed out on return to BASIC, and converted into numbers using the function VAL. As the index register is used for counting, only 256 bytes can be transferred using this program, but it would be easy to modify the program to perform more transfers.

Disassembled listings with comments and a separate listing (for ease of copying into BASIC DATA statements!) are given.

This program was prepared using a machine language handler written by the author, and the listings produced by this handler and by a modified version of the 'disassemble' part of the PETSOFT (C) ASSEMBLER 'EXEC' program.

IEEE bus handshake routine - main program

```
1800 A200   LDX #00     prepare index register
1802 A9FB   LDA #FB     set ATN low
1804 2D40E8 AND E840
1807 8D40E8 STA E840
180A A928   LDA #28     MLA (28 for this device)
180C 8501   STA 01
180E 208018 JSR 1880    handshake into bus
1811 A908   LDA #08     GET
1813 8501   STA 01
1815 208018 JSR 1880    handshake
1818 A948   LDA #48     MTA
181A 8501   STA 01
181C 208018 JSR 1880    handshake
181F A9FD   LDA #FD     set NRFD low (ready to receive data)
1821 2D40E8 AND E840
1824 8D40E8 STA E840
1827 A9F7   LDA #F7     and NDAC low also
1829 2D21E8 AND E821
182C 8D21E8 STA E821
182F A904   LDA #04     set ATN high
1831 0D40E8 ORA E840
```

```
1834 8D40E8 STA E840
1837 A008   LDY #08      ready to count 8 bytes
1839 20B018 JSR 18B0     handshake data from bus
183C A502   LDA 02       result to A
183E 9D0119 STA 1901,X   store in  1901+X
1841 E8     INX
1842 88     DEY
1843 D0F4   BNE 1839     jump if Y not zero
1845 A9FB   LDA #FB      set ATN low
1847 2D40E8 AND E840
184A 8D40E8 STA E840
184D A902   LDA #02      set NRFD high
184F 0D40E8 ORA E840
1852 8D40E8 STA E840
1855 A908   LDA #08      set NDAC high
1857 0D21E8 ORA E821
185A 8D21E8 STA E821
185D A95F   LDA #5F      UNT
185F 8501   STA 01
1861 208018 JSR 1880     handshake to bus
1864 A904   LDA #04      set ATN high
1866 0D40E8 ORA E840
1869 8D40E8 STA E840
186C CE0019 DEC 1900     decrease counter
186F D091   BNE 1802     jump if not zero
1871 60     RTS          return to BASIC program
```

subroutine to handle handshake into bus

```
1880 AD40E8 LDA E840     NRFD ?
1883 2940   AND #40
1885 F0F9   BEQ 1880     jump back if not ready
1887 A501   LDA 01       ready:  get data byte
1889 49FF   EOR #FF      complement it
188B 8D22E8 STA E822     send to bus
188E A9F7   LDA #F7      set DAV low
1890 2D23E8 AND E823
1893 8D23E8 STA E823
1896 AD40E8 LDA E840     NDAC ?
1899 2901   AND #01
189B F0F9   BEQ 1896     jump back if not accepted
189D A908   LDA #08      accepted;  set DAV high
189F 0D23E8 ORA E823
18A2 8D23E8 STA E823
18A5 A9FF   LDA #FF      255(10) into bus
18A7 8D22E8 STA E822
18AA 60     RTS          return to main
```

subroutine to handle handshake from bus

```
18B0 A902   LDA #02      set NRFD high
18B2 0D40E8 ORA E840
1885 8D40E8 STA E840
18B8 AD40E8 LDA E840     DAV ?
18BB 2980   AND #80
18BD D0F9   BNE 18B8     jump back if not valid
18BF AD20E8 LDA E820     get data byte from bus
18C2 49FF   EOR #FF      complement
18C4 8502   STA 02       store in $ 0002
```

```
18C6 A9FD   LDA #FD     set NRFD low
18C8 2D40E8 AND E840
18CB 8D40E8 STA E840
18CE A908   LDA #08     set NDAC high
18D0 0D21E8 ORA E821
18D3 8D21E8 STA E821
18D6 AD40E8 LDA E840    DAV high ?
18D9 2980   AND #80
18DB F0F9   BEQ 18D6    jump back if not
18DD A9F7   LDA #F7     set NDAC low
18DF 2D21E8 AND E821
18E2 8D21E8 STA E821
18E5 A9FF   LDA #FF     255(10) into bus
18E7 8D22E8 STA E822
18EA 60     RTS         return to main
```

IEEE bus handshake routine listing

```
1800 A2 00 A9 FB 2D 40 E8 8D
1808 40 E8 A9 28 85 01 20 80
1810 18 A9 08 85 01 20 80 18
1818 A9 48 85 01 20 80 18 A9
1820 FD 2D 40 E8 8D 40 E8 A9
1828 F7 2D 21 E8 8D 21 E8 A9
1830 04 0D 40 E8 8D 40 E8 A0
1838 08 20 B0 18 A5 02 9D 01
1840 19 E8 88 D0 F4 A9 FB 2D
1848 40 E8 8D 40 E8 A9 02 0D
1850 40 E8 8D 40 E8 A9 08 0D
1858 21 E8 8D 21 E8 A9 5F 85
1860 01 20 80 18 A9 04 0D 40
1868 E8 8D 40 E8 CE 00 19 D0
1870 91 60 EA EA EA EA EA EA
1878 EA EA EA EA EA EA EA EA
1880 AD 40 E8 29 40 F0 F9 A5
1888 01 49 FF 8D 22 E8 A9 F7
1890 2D 23 E8 8D 23 E8 AD 40
1898 E8 29 01 F0 F9 A9 08 0D
18A0 23 E8 8D 23 E8 A9 FF 8D
18A8 22 E8 60 EA EA EA EA EA
18B0 A9 02 0D 40 E8 8D 40 E8
18B8 AD 40 E8 29 80 D0 F9 AD
18C0 20 E8 49 FF 85 02 A9 FD
18C8 2D 40 E8 8D 40 E8 A9 08
18D0 0D 21 E8 8D 21 E8 AD 40
18D8 E8 29 80 F0 F9 A9 F7 2D
18E0 21 E8 8D 21 E8 A9 FF 8D
18E8 22 E8 60
```

```
0001 data to go into bus
0002 data from bus

1900 counter for number of data transfers

1901 start of results area
```

John A. Cooke

Department of Astronomy
University of Edinburgh
Royal Observatory
Edinburgh EH9 3HJ

Users' Directory & Announcements

One of the major advantages in being a member of the PET Users' Club is the ability to get hold of PET related software and ideas. Although the Common Library of programs is now flourishing, we get frequent requests for names of people who have written software for a specific application.

We are therefore publishing, in each issue, a current Users' Directory, containing lists of people writing software, importing literature or starting local PET Groups. If you would like to use your PET for fun and profit, why not offer personal tutoring in PET programming to new PET owners. Alternatively, if you require a program to be written for you, ask for contacts via the Users' Directory. The possibilities are endless. To print more official company advertisements, please write to the Editor, PET Users' Club, at the address below.

To include your name in the Users' Directory, please complete the following form:

To: The Editor, PET Users' Club, **Commodore** Systems,
360 Euston Road, London NW1 3BL

NAME .....

ADDRESS .....

.....

Services Offered/Specialist area of interest: .....

.....

To include as many contacts as possible, we must restrict each User to only one line of description.

Commodore reserves the right to edit or withdraw any entry.

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Mr. A. Clark
Dept. of Civil Engineering, University of Newcastle upon Tyne, NE1 7RU
Maths/Engineering, Instrumentation and Control

Anthony Mothew
7 Ashfields, Loughton, Essex (Home 01-508-8355, Work 01-472-5347/4474)
Private pilot (Aviation & Navigation)

If someone is offering the kind of service you require, then please contact them - not Commodore. Entries are published on a first-come-first-served cyclical basis.

LETTERS SECTION

Letters should be addressed to:

The Editor
PET Users' Club
Commodore Systems
360 Euston Road
London NW1 3BL

SIMULATING AN HP-25 ON THE PET

From Mr. J. Clark, 5 Parkview House, 9a Eastbury Road, Watford, WD1 4PZ

"Following a remark in Newsletter No. 3, I have been experimenting with simulating a programmable calculator on my PET. I've been simulating an actual model (up to a point, anyway) - in my case a Hewlett-Packard HP-25. This machine is quite a versatile calculator, featuring Reverse Polish logic, a good, but not enormous, range of pre-programmed functions, and a reasonable amount of program capacity including some merging of key-strokes. Some addressable memories are available, with memory arithmetic.

I have written a BASIC program to simulate this on a PET, and it seems to run OK, certainly as far as all the major features are concerned. I have decided not to include two features of the HP-25 at present: I've ignored 'Error' messages and just let PET's BASIC do its own thing when improper operations or overflows occur; and I haven't modelled the HP's capacity to change the format of output numbers either manually or under program control.

I've written a working program, but I haven't had much time available so far to polish it up, so it's probably still rather clumsy. I think the only bugs left (if any) will be wrong responses if you enter idiotic sequences of key-strokes. It's been quite an interesting

exercise, but the end result (in BASIC anyway) seems likely to be of little value. As a simulation of a live calculator, it's fine, but when running a stored program, it's painfully slow at present. Maybe further development work could speed things up a bit, of course. It's quite a longish program too; with a small program of about 15 steps stored and run the FREstore message is just over 2000.

I hope these notes on progress so far may be of some interest."

Ed: Thanks for taking up our suggestion and reporting on progress thus far. If you can speed up the program with some machine code routines, we would very much like to publish it.

* * * * * * * * * * * *

STAR TREK

From Mr. Frank Bell, 26 Worcester Road, Uxbridge, Middx, UB8 3TH

"I would be most grateful for your help. My hobby is the development of computer games, and it is my aim to produce a definitive version of Star Trek using PET's unique capabilities. I have several versions, all massively long, and these when pruned to fit are without character or interest. I would very much appreciate if you will appeal to Club Members on my behalf, asking for program listings or source references of short (ie less than 8K) versions of Star Trek. I will, of course, return any material that is loaned to me in this way, and if any substantial help is forthcoming, will gladly send a copy of the resultant program to the person concerned.

In closing, I must congratulate you on the very considerable improvement in the Newsletter. I have the feeling that on the progress made so far, the future issues will prove to be a valuable asset to PET owners."

* * * * * * * * * * * *

TWO USES OF PET IN A LABORATORY

From Michael J. Smyth, University of Edinburgh, Department of Astronomy, Royal Observatory, Edinburgh, EH9 3HJ

"Graph Plotting

PET can function as a simple graph plotter, using a laboratory chart recorder. The function to be plotted is scaled to the range 0 - 255 and the resulting value POKEd into the User Port. An inexpensive ZN425E digital-to-analogue converter (R.S. Components Limited) converts the 8 bits into a voltage, which is plotted. Delay loops are inserted to prevent the output from varying too fast for the recorder to follow.

Control of Stepping Motor

PET can generate TTL pulses to control a stepping motor (eg a spectrometer drive) by POKEing successive 1s and 0s into the User Port. The use of BASIC limits the speed to about 50 irregular pulses per second. Machine language allows pulse rates of many thousands per second (if necessary!) but the pulse trains are split up by hardware interrupts every 1/60th second, when PET updates its clock and scans the keyboard. SEI (set interrupt disable) at the beginning of the subroutine suppresses these interrupts; CLI (clear interrupt disable) at the end restores normal functions."

* * * * * * * * * * * *

APOLOGIES to Mark Taylor for missing out a program line from his letter printed last issue. His third paragraph should read:

3. I have found an error in the Disassembler programme. Line 271Ø should read

```
271Ø      IF I <> 1Ø8 THEN 261Ø
```

not 1Ø2 as at present.

* * * * * * * * * * * *